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ABSTRACT

This paper presents a comparison of the effects of two pacing contingencies on the rate and accuracy of unit completion in commercially available social studies materials. A class of sixth grade pupils were used as subjects. When the pupils were allowed to proceed through the materials at their own pace (Self Paced), the mean number of units completed was 1.54 per day. When the class had to complete two units per day or receive a failing grade (Forced Paced), the number of units completed increased. With a reapplication of the Self Paced condition, unit completion decreased. But when the Forced Paced condition was reinstated, class members again increased their mean rate of unit completion. Data for three selected pupils revealed that the rates of unit completion for the median and lowest pupil were affected the most by the experimental procedures. Accuracy increased over time and appeared to be a function of exposure to the materials. (Author/SDH)

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THE EFFECTS OF TWO PACING CONTINGENCIES IN A KELLER TYPE PROGRAM
AT THE ELEMENTARY SCHOOL LEVEL USING COMMERCIALY AVAILABLE MATERIALS¹

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An increasing number of research papers have reported applications of the contingency management procedures set forth by Keller (2). These procedures have been applied in college level courses in the experimental analysis of behavior (2, 4, 5). Other studies have demonstrated that these contingency management techniques were effective in teaching general subject-matter courses in psychology at the college level (9, 1, 12).

The methods employed at the college level tend to present problems when attempting to implement contingency management procedures at the elementary school level. Problems such as finding staff to perform the various duties, paying for additional staff, training teachers at the elementary school to program materials, etc., may be partially responsible for the sparse literature in this area with elementary school populations.

Only recently have subject-matter programming methods, applicable to the elementary school situation, been reported (8). The methods

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reported were managed by a single teacher and his pupils, free of cost, appropriate for two typical subject-matter areas in the elementary school curriculum (science and social studies), and the procedures were rated highly by the pupils. However, the pacing results were not conclusive since the outcomes were evaluated with an AB design (11); the amount of teacher time to program the courses of study was considerable; the results may not have much generality to the typical classroom since most teachers lack the skills to program materials; and the materials used were not commercially available.

The purposes of the present study were: (a) to replicate a previous report (8) with materials that are commercially available in most school districts, (b) to compare the pacing results with a more sophisticated research design, and (c) to evaluate two types of pacing procedures (Self and Forced).

Method

Subjects and Setting

Eleven to 16 sixth-grade pupils in a combination fifth and sixth-grade classroom at Columbia Elementary School in Spokane, Washington, were involved in this research. The fifth-grade pupils had another teacher in a different room for social studies. The number of pupils was variable because of the transient nature of the population that attended the school.

The classroom was managed by a token (point) economy system. Procedural and developmental details can be found elsewhere (6, 7). Briefly, pupils earned points for appropriate classroom behavior such as

completing assignments, remaining in their seats, and accuracy of performance. Points were lost for inappropriate classroom behaviors such as fighting, chewing gum, cheating, and failing to complete assignments. Points were exchanged for various desirable items (privileges) in the school environment. Such activities as recess, after-school sports, being on a committee, and seeing the pets in the room could be purchased with points. Points were accumulated or lost for varying periods of time before they could be exchanged (range 3 to 10 days) for privileges.

Curriculum and Cost

The curriculum used in this study was a social studies kit designed to develop map and globe skills at the intermediate elementary school level. The kit, Map and Globe Skill Builder Kit (10), is commercially available from Science Research Associates, Inc., at a cost of \$116.30. Pupil booklets for the kit cost \$.69 each. The kit can be re-used; only the pupil booklets were consumed.

Procedures

The social studies period was held from 11:00 to 11:45 a.m. each morning. This was the only time that pupils were allowed to work on the materials. The complete staff, except for the teacher, were pupils already enrolled in the classroom. A list of the various staff members and their respective duties follows.

Pupils. The pupils were to: (a) pass out materials at the beginning of the class period; (b) answer the items on the various skill-card units;

(c) correct their answers; (d) receive points based on the accuracy of their answers.

Proctors. Pupils who had previously completed a set of seven units of material were selected by the teacher to be proctors for that set of seven units. The units were already color-coded and labeled by levels in groups of seven. The duties of the proctors were to: (a) discuss possible answers with pupils if the need arose, (b) sign a pupil's answer sheet when all of the items had been completed, and (c) list the names of the various pupils who completed the written items on the various units.

Teacher. The teacher's duties were to: (a) act as a proctor for units that no pupil had been appointed to, (b) settle disputes between pupils and proctors, (c) give additional help, (d) deliver lectures and lead discussions over the material in the pupil booklet, (e) handle the duties of absent proctors, (f) initial answers that were erased or written over before pupil correction, (g) award points based on the accuracy of the pupil correction, (h) make periodic checks on the accuracy of pupil self-scoring and (i) oversee the general operation of the contingency management system.

The names of the pupils and their respective duties were posted on a bulletin board. This was done to give the pupils feedback as to the proper procedures to follow. The typical sequence for an individual pupil can be described in the following. The pupil answered the items on the skill-card unit. He went to the appropriate proctor for the work to be signed, if all the items had been answered. It was signed and

could be taken to the teacher. The teacher initialed any erased or written-over answers. The pupil was given a key and corrected his work. The pupil returned to the teacher for the points he had earned based on his accuracy. He returned his old materials and picked up a new skill card.

Response Definitions: The Dependent Variables

Two measures were taken: the rate at which the various units were completed by the class and the accuracy of pupil performance during each of the experimental conditions.

A unit contained 20 fill-in or multiple choice items over the material on an individual skill card. A unit was defined as complete if all 20 items had been answered and corrected by the pupil. Since means were presented, the total number of units completed in an experimental condition was divided by the number of pupils present plus the days in the condition.

The accuracy of performance was calculated as the mean percent of the items that were answered correctly in each of the two experimental conditions. This was calculated by adding the number of items correct and dividing by the number of items in each experimental condition. A response was defined as correct if it matched the printed answer on the key that the pupil used to correct his answers. All answer keys were held by the teacher until a pupil was ready to check his answers.

Reliability of measurement was taken in two ways. First, the pupil accuracy for correcting their units was compared to the various answer keys by another pupil in the class at the termination of the experiment. Agreement was 95 percent across 50 papers taken at random from each of

the experimental conditions. The randomization was accomplished by saving papers of pupils who came to the teacher for their points after the units had been completed. If the second hand on the clock in the room was on a multiple of six, the paper was saved. Second, a comparison was made as to the date that the pupils completed the various units and the date color-coded in the teacher's gradebook. Agreement across the 50 papers was 100 percent.

Experimental Conditions: The Independent Variables

There were two alternating experimental conditions. Each condition was applied twice.

Self Paced (SP). During this condition the class was informed that they could proceed at their own pace through the materials as long as they worked the whole period. They could do as many units as they wished each day. The condition was applied twice for different lengths of time. The first application lasted for 12 days, the second for 6 days.

Forced Pace (FP). During this condition the teacher informed the class that each pupil had to complete a minimum of two units per day. If a pupil did not finish two units, he was failing until he made up this deficiency. Therefore, he had to complete three units the next class period if he only completed one the previous class period to avoid failing. After the pupil completed two units per day, he could continue to work or engage in some privileged behavior in the room, such as seeing the animals or going to the library. If a pupil was absent he was not responsible for making up the units he missed. This condition was applied twice. The first application lasted for 12 days, and the second for 22 days.

Results

The mean number of units that the class completed per day in each of the experimental conditions (SP, FP) can be seen in Fig. 1. During

Insert Figure 1 about here

the first Self Paced Condition the mean number of units that were completed by the class was 1.54. With the introduction of the Forced Paced Condition, the mean number of units that the class completed increased to 2.29. With the reintroduction of the Self Paced Condition (SP), the mean number of units completed per day decreased to 1.82. With the second Forced Paced Condition (FP), the mean number of units completed by the class increased to 2.25 per day.

Individual rates for three selected pupils (S-1, S-2, S-3) are plotted in Fig. 2. The pupils were selected on the basis of their performance in the first Self Paced Condition. The pupil with the lowest rate of unit completion was labeled S-1. The median pupil was labeled S-2. The pupil with the highest rate of unit completion was designated

Insert Figure 2 about here

as S-3. S-1's rate of completion ranged from 0 to 2 units per day during both Self Paced Conditions. During the Forced Paced Conditions, S-1 completed at least two units per day.

Pupil S-2 had a median rate of unit completion during the first Self Paced Condition (range 0 to 3 units per day). With the application

of the first Forced Paced Condition (FP), the pupil completed two units per day. During the last Forced Paced Condition (FP), the pupil completed two units per day. On the last two days he completed five units per day.

The third pupil (S-3) exhibited the highest rate of unit completion in the class. During the first Self Paced Condition (SP), S-3 completed from one to four units per day. With the introduction of the Forced Paced Condition, the number of units completed increased (range 2 to 6 units per day). During the second Self Paced Condition (SP), the pupil's rate of unit completion continued to increase (range 2 to 10). During the last three days, he completed nine and ten units on two of the days. Since S-3 completed all of the units, no data were available for the second Forced Paced Condition.

The data were plotted in terms of the percent of the total class that met the Forced Paced criteria of "two units per day across the experimental conditions (Fig. 3). The percent of the class that met the Forced Paced criteria during the first Self Paced Condition ranged from

Insert Figure 3 about here

0 to 92 percent. With the introduction of the Forced Paced Condition (FP), all of the class met the criteria with the exception of one pupil. During the second Self Paced Condition (SP), the percent of the class that met the Forced Paced Criteria of two units per day ranged from 36 to 78 percent. During the second Forced Paced Condition (FP), all of the class met the criterion.

The mean percent of unit items answered correctly in each of the experimental conditions is shown in Fig. 4. The pupils' accuracy appeared to be an increasing function of exposure to the material in the kit.

Insert Figure 4 about here

The lowest mean percent for accuracy was recorded in the first Self Paced Condition (SP), and the highest in the last Forced Paced Condition (FP).

Discussion

The study indicated that the college instructional procedures developed by Keller (2) such as proctoring, using small units of material, frequent testing, and immediate feedback can be modified and utilized at the elementary school level. Portions of the Keller procedure were replicated with materials suitable for elementary school children which were commercially available to most school districts. By utilizing commercially available materials, teachers who cannot program curriculum can still benefit from using the procedures described in this research. The cost of the materials may seem high at first, but with repeated use of the kit, cost decreases. In terms of the cost of materials it may be cheaper than a high hourly wage of a teacher used to program typical subject-matter materials.

The use of pupils already in the room to act as proctors did not in their opinion affect their performance. The proctors' tasks on the whole were minimal (e.g., scanning the paper to see that all the items were answered, signing the paper, placing the pupils' names on a sheet

of paper, and giving help when needed). If a proctor could not help a pupil, help was received from the teacher.

The comparisons of the two experimental conditions yielded conflicting results across individuals. The pupil (S-3) who developed the highest rate of unit completion (SP), continued to go through the material quickly regardless of the subsequent conditions. The median and low pupils based from the first Self Paced Condition worked at higher and more steady rates when they were under the Forced Paced Conditions. The experimental design showed a functional relationship between the procedures and the units completed by the class. The minimum requirement contingency for passing of two units per day (Forced Paced) generated higher rates of performance than did the go at your own pace conditions (Self Paced), traditionally found in Keller's procedures. This finding replicates the research of Lloyd (3), and Malott and Svinicki (5) with college students.

Accuracy was not systematically affected by the pacing procedures. Having the pupils complete two units per day did not appear to require them to rush through the materials writing down just any answer. It is quite possible that awarding points based on the pupils' accuracy served to increase it.

Pupils behaved in ways that were probably a reflection of the positive features of the method of instruction. The pupils were actively involved in the class; writing, talking to the teacher and the proctors, not being held back by others, progressing in small steps, and receiving immediate feedback on their performance. There were several aspects of

this research that are worthy of note: (a) the materials employed are available to most school districts, (b) elementary school pupils can function in roles traditionally carried out by adults, (c) the procedures could be managed by a single teacher and his class, (d) the pacing procedures were evaluated, (e) the procedures could be implemented at the elementary school level, and (f) the procedures could be employed with the traditional curriculum taught at the elementary school level.

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Footnotes

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2. Now at the Department of Human Development, The University of Kansas. Reprints may be obtained from T. F. McLaughlin, Department of Human Development, The University of Kansas, Lawrence, Ks. 66045.

Figure Captions

Fig. 1. The mean number of units completed by the class as a function of each experimental condition. The pupils could complete units at their own pace during the Self Paced Conditions (SP). During the Forced Paced Conditions (FP), each pupil had to complete a minimum of two units per day or he was failing.

Fig. 2. The number of units completed by three selected pupils in the various experimental conditions. S-1 was the pupil with the lowest rate of unit completion during the first Self Paced Condition. S-2 was the pupil with the median rate of unit completion, and S-3 was the pupil that developed the highest rate of unit completion. Arrows indicate when the pupils finish all units.

Fig. 3. The percent of the class that met the Forced Paced Criteria of completing two units per day across all the experimental conditions.

Fig. 4. The mean percent correct plotted as a function of the experimental conditions for the total class.







